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ABSTRACT

This training guide, developed during a project to retrain defense industry workers at risk of job loss or dislocation because of conversion of the defense industry, is designed for a course in blueprint reading for welders. The following are among the topics covered in the course: information on a blueprint; orthographic projection; views in orthographic drawings; representing an object; sketching an isometric drawing; surface identification; basic lines and their identification; local and general notes; title blocks; dimensions; dimension units; rules for dimensioning; tolerance dimensions; welding symbols; reference lines; basic weld symbols; types of welds; supplementary symbols; welding symbol and elements; fillet welds and finishes; and groove, plug, slot, spot, seam, and flange welds. Included in the guide are the following: course outline; transparency masters; student handouts; quiz; student exercises; and reference tables. (MN)

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Blueprint Reading for Welders

Training Guide

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Table of Contents

Table of Contents.....Page 1
Information on a Blueprint.....2
Team Quiz 2
Orthographic Projection 3
Views in Orthographic Drawings.....4
Representing an Object 5
Sketching an Isometric Drawing.....6
Surface Identification 7
Basic Lines.....8 - 10
Your Notes.....11
Identifying Basic Lines.....12 - 13
Local and General Notes.....14
Title Blocks 15
Dimensions.....16
Dimension Units 17-19
Rules for Dimensioning 20
Dimensioning Practice 21
Tolerance Dimensions 22
Welding Symbol 23
Reference Lines.....24
Basic Weld Symbols.....25
Types of Welds 26
Supplementary Symbols.....27
Welding Symbol & Elements.....28
Your Notes.....29
Fillet Welds & Finishes.....30-33
Groove Welds.....34-38
Plug Welds 39-40
Slot Welds 41-42
Spot Welds 43-45
Your Notes.....46
Seam Welds.....47-48
Flange Welds.....49-50
Classification of Characteristics.....51

Information on a Blueprint

Information found on a blueprint:

- Parts to be manufactured
- Dimensions
- Notes
- Material
- Title of the drawing and part
- Drawing number
- Manufactures name
- Tolerances
- Scale of the drawing
- Names of the drafter, engineer, and checkers
- Drawing and approval dates
- Revision information

Team Quiz:

Look at the provided prints in your folder. Locate the requested information below. With your partner, number the various parts of a print.

1. Locate the parts, as shown in line drawings.
2. Point out the dimensions.
3. Point out the notes.
4. Where is the material listed?
5. What's the title of the drawing and the drawing number?
6. Where is the Onan/Cummins name located on the print?
7. Point out the tolerances.
8. What is the scale of this drawing?
9. Who drafted this print?
10. Who approved the print?
11. When was the print drafted?
12. Point out the revision information.

Orthographic Projection

Orthographic projection is a method of representing the true shape of an object on a single plane.

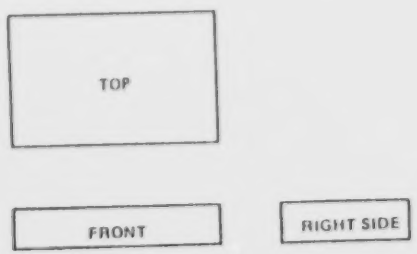
- Every line of an object is on a single plane.
- Every line of the object must appear as a line or point on the plane of projection.
- Lines that can be seen are shown as solid lines.
- Lines that are not visible, because they are hidden by some part of the object, are represented by dashed lines.

Orthographic projection is divided into 6 views:

Front View:	main view of the part that shows most detail.
Top View:	projection upward from front view.
Right side:	view to the right of the front.
Left side:	view to the left of the front.
Bottom view:	opposite the top view.
Back view:	opposite the front view.

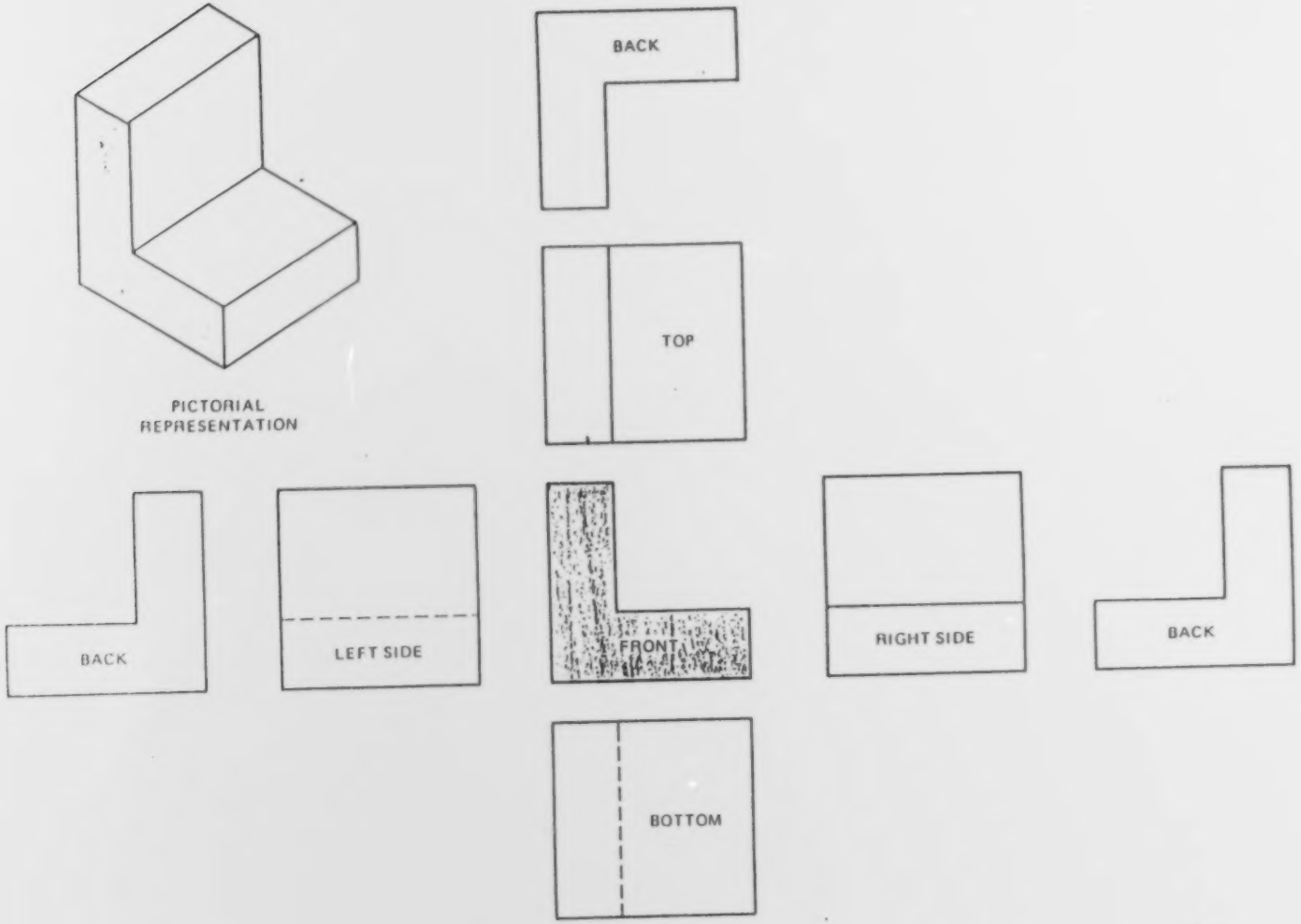
Principle Projections:

The principle projections are called front, top and side views. The process of projecting the essential views into a single plane is known as orthographic projection.

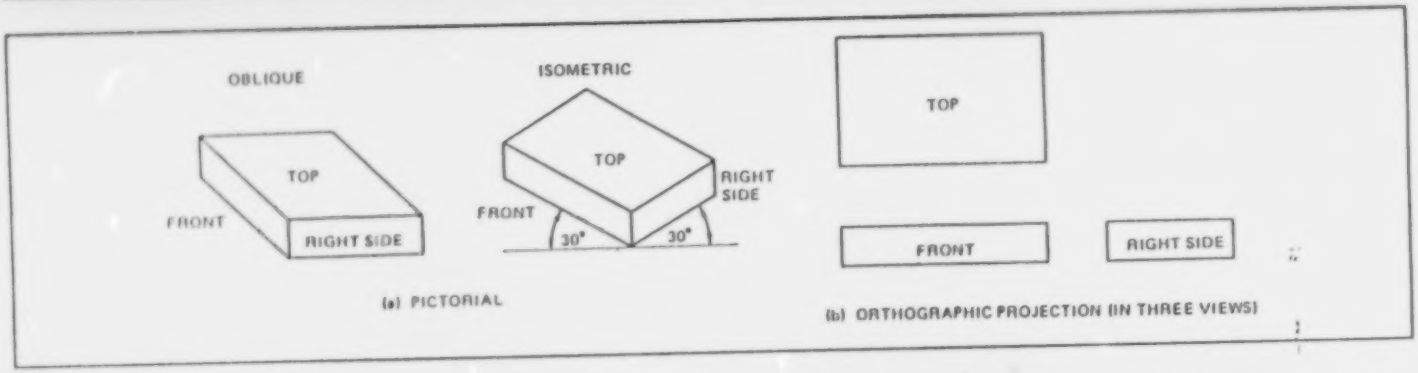


Views in Orthographic Drawings

PICTORIAL REPRESENTATION



Representing an Object



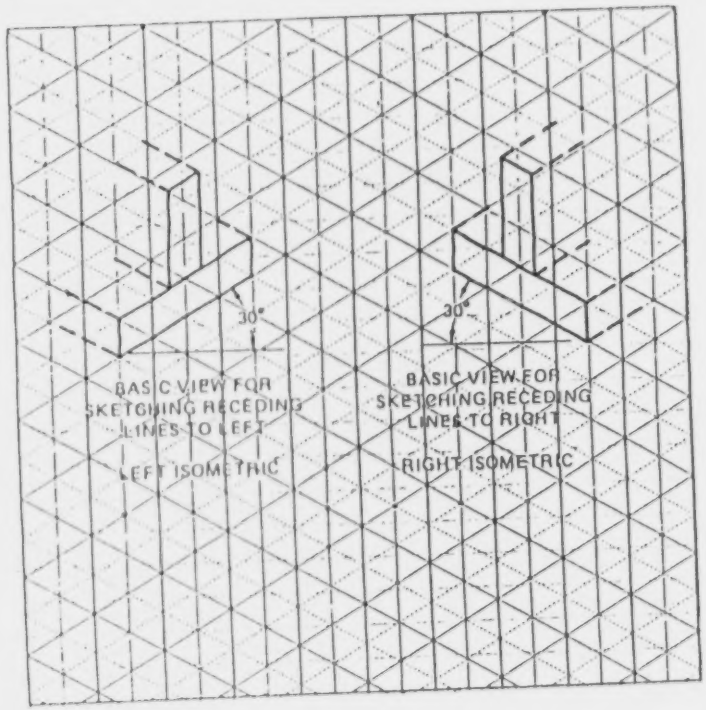
Oblique: To develop an oblique drawing, an orthographic view of the object is first drawn which best describes the shape and shows the most detail of the object.

After the orthographic view is completed, one should draw parallel receding lines about 45 degree angles from the corners of the view (either to the right or to the left) to develop the three-dimensional effect. The extent of the receding lines is about one-half the length that would be shown for an orthographic drawing.

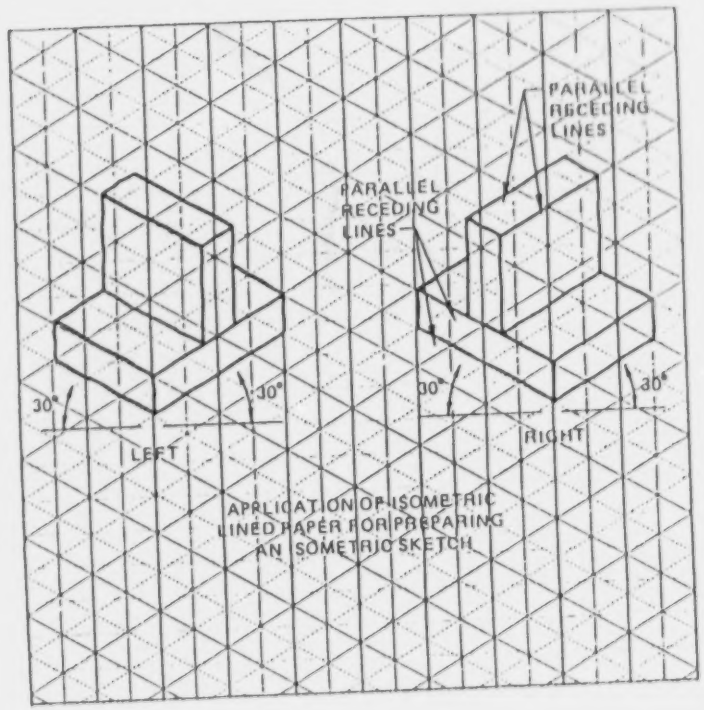
Isometric: To develop an isometric sketch, isometric graph paper is preferable. An isometric sketch has all of its surfaces shown at 30 degree angles. In the initial preparation of the sketch, a view of the object that best shoes its shape and detail is selected and sketched at 30 degrees.

After completion of the basic view, parallel receding l;lines are sketched at 30 degree angles from each of the corners. Only those lines that represent the visible part of the object are shown. The sketch is completed by drawing the back edges.

Preliminary view for sketching isometric drawing of a fabricated T-support.



Left and right isometric sketches of a fabricated T-support.



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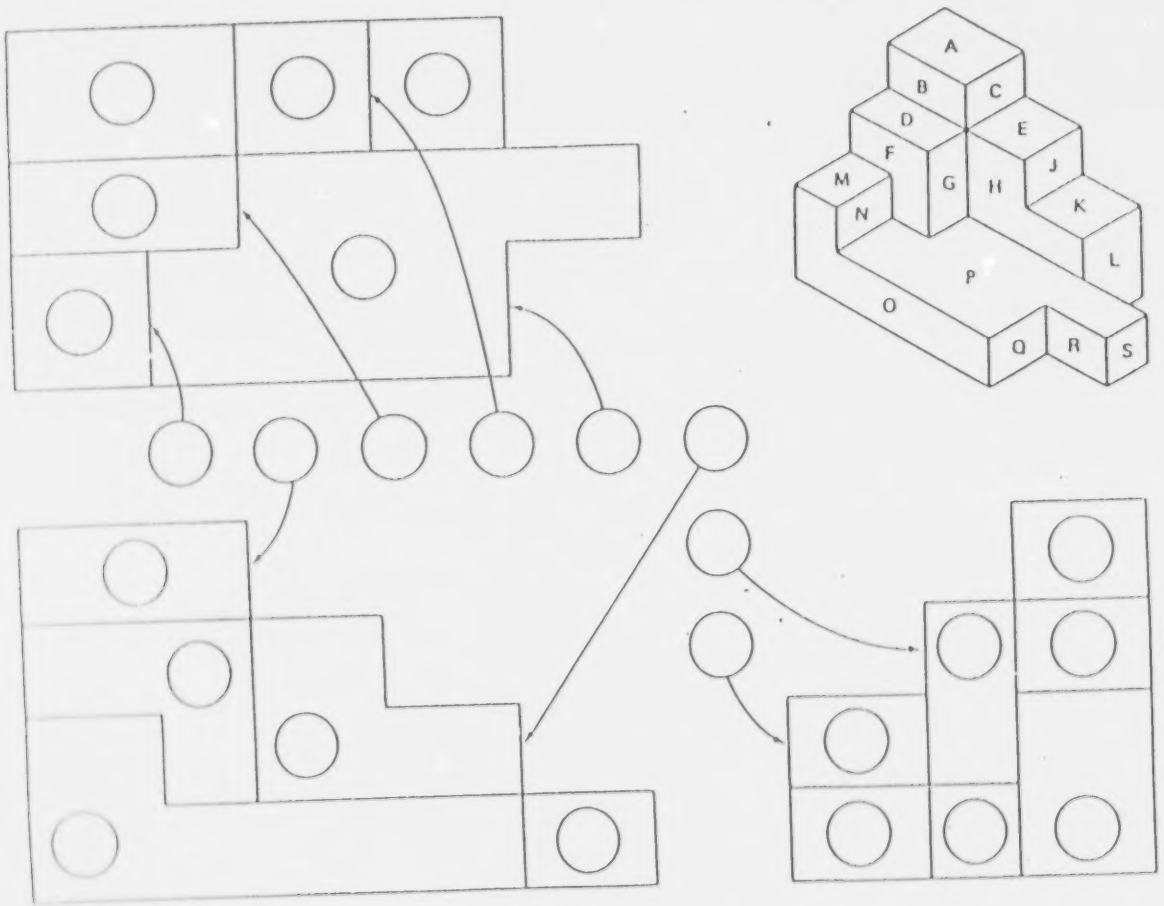
Surface Identification

Enter the letters from the pictorial view into the corresponding balloons on the orthographic views.



15

16

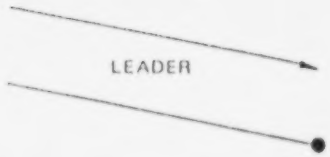
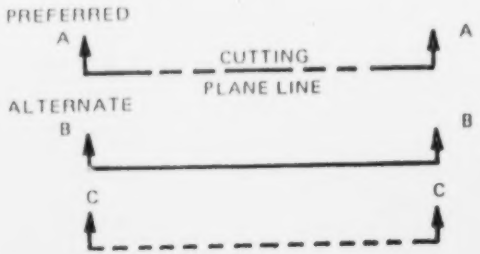
Basic Lines

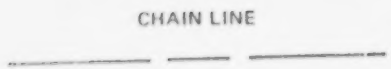
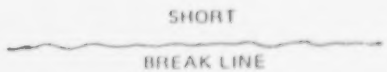
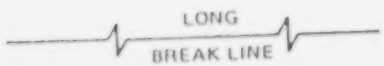
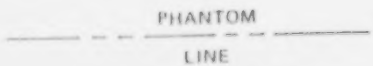
There are several different types of lines used on a print.
Each line has a different meaning.

The purpose of each line deals with:

1. Shape of an object
2. Dimensioning of an object

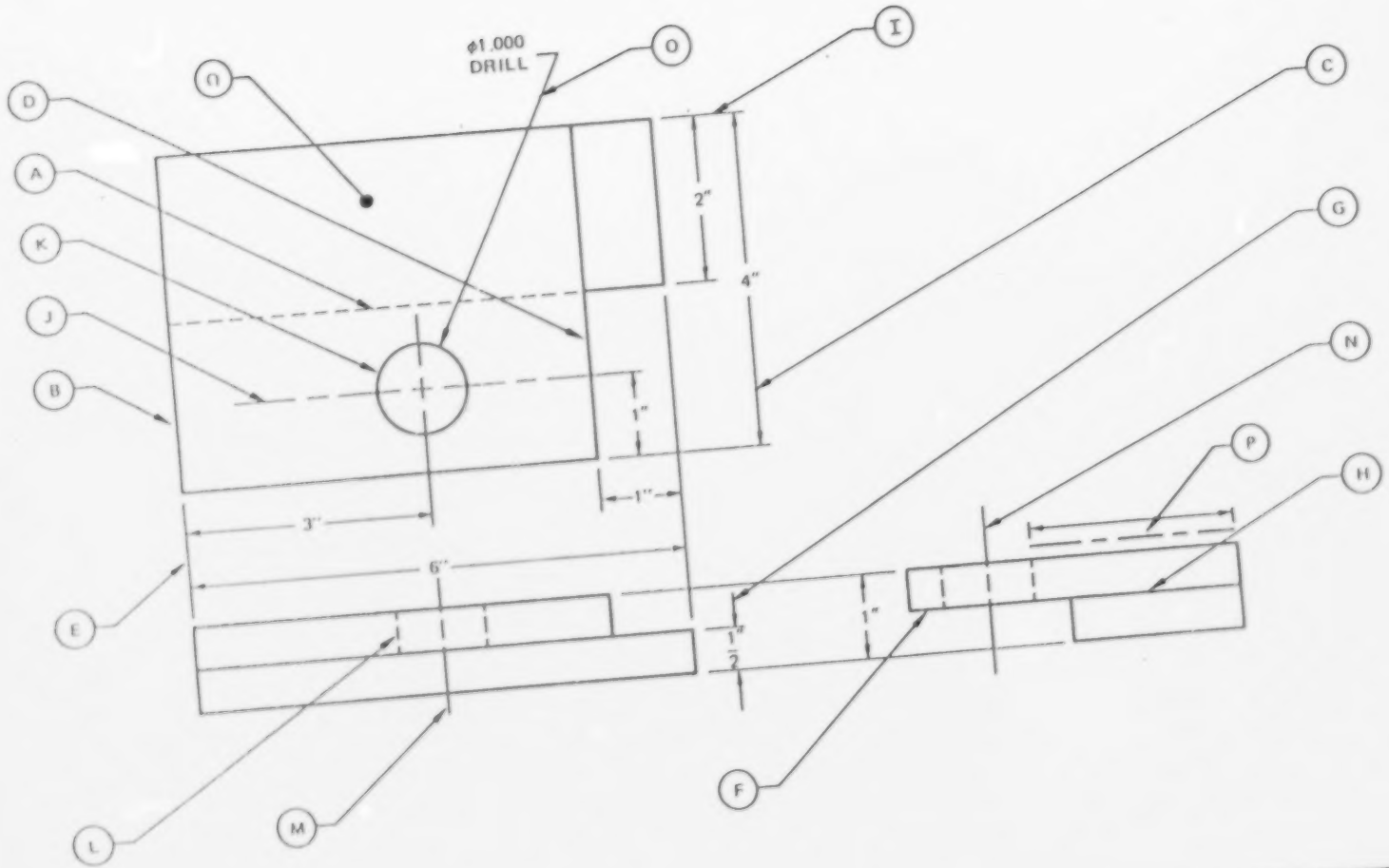
Type of Line	Description	Purpose
OBJECT LINE	Thick solid line.	To show the visible shape of a part.
HIDDEN LINE	Broken line of medium thickness.	To show edges and outlines not visible to the eye.
CENTER LINE	Fine, broken line made up of a series of short and long dashes alternately spaced.	To show the center of circles, arcs and symmetrical objects and to aid in dimensioning these parts.
	Extension lines: fine lines that extent from the object with a light break between. Dimension lines: fine lines with arrowheads, unbroken except where the dimension is	Extension lines: show dimensioning points. Dimension lines: touch the extension lines and show distance given by the dimensions.

Type of Line	Description	Purpose
	Fine, straight line with an arrowhead or round solid dot at one end. It is usually drawn at an angle.	Points directly to surface for the purpose of dimensioning or adding a note. A dot may be used at the end of the straight line where reference is made a surface area.
	A heavy, broken line made up of a series of short dashes alternately spaced (or solid heavy lines or long dashes). Arrowheads are placed at right angles to the cutting plane lines.	Indicate where an imaginary cut is made through the object. The arrow points in the direction in which the section should be viewed. Letters next to the arrowheads identify the section in chases where more than one section is shown on the drawing.
	Series of fine lines - solid or solid and broken - arranged in specific patterns. They may be shown either straight or curved. When shown straight, they are usually drawn at 45 degree angle.	Indicate the imaginary cut surface referred to by the cutting plan line. To represent various kinds of materials.

Type of Line	Description	Purpose
 CHAIN LINE	Heavy, broken line made up of a series of long and short dashes alternately spaced.	Indicates the location and extent of a surface area.
 SHORT BREAK LINE	Heavy, irregular line drawn freehand.	To show a short break. To conserve space on a drawing. To show a partial section.
 LONG BREAK LINE	Ruled, light line with freehand zigzags.	To show a long break. To conserve space on a drawing.
 PHANTOM LINE	Light, broken line made up of a series of one long and two shot dashes.	To show alternate positions of a part. To show relationship of existing part to new part. To show machined surfaces.

Your Notes

Identifying Basic Lines



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Identifying Basic Lines

Refer to the drawing above to identify the types and lines and their functions.

Identify to following types of lines:

A _____
B _____
C _____
D _____
E _____
F _____
G _____
H _____
I _____
J _____
K _____
L _____
M _____
N _____
O _____
P _____

27

Given the function or functions of the following lines:

A _____
B _____
C _____
E _____
J _____

Bonus Question:
What does Q have reference to?

_____

28

Local & General Notes

A note is lettered information concerning the details of construction. The note explains, specifies, or refers to the material and/or processes needed to make the part. Notes help to conserve space on the print, and to save time in preparing the drawing. It is often shown as an abbreviation or symbol.

Local Notes: When a note applies to a particular part on an object, it is called a local note. Such a note is placed near one of the views representing the part.

General Notes: A general note applies to the drawing as a whole. It is placed in an open space away from the views so that it can be seen easily.

Local Note

This surface must be flush and have no weld spatter.

29

General Note

Example:
All welds made using GTAW.

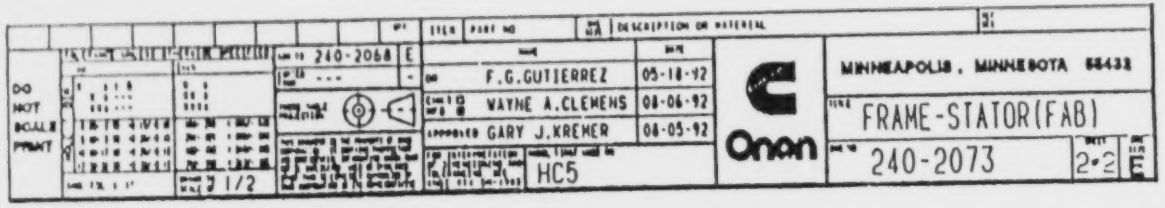
30

Title Blocks

Title blocks consist of:

A. Name of part or project
B. Quantity required
C. Material description
D. Scale size used
E. Drawn by
F. Checked by
G. Drawing Number
H. Dates
I. Tolerances
J. Onan/Cummins name
K. Drawing Projection
   3rd Angle vs. 1st Angle

Place the corresponding letters in the Onan/Cummins title block below:



31

32

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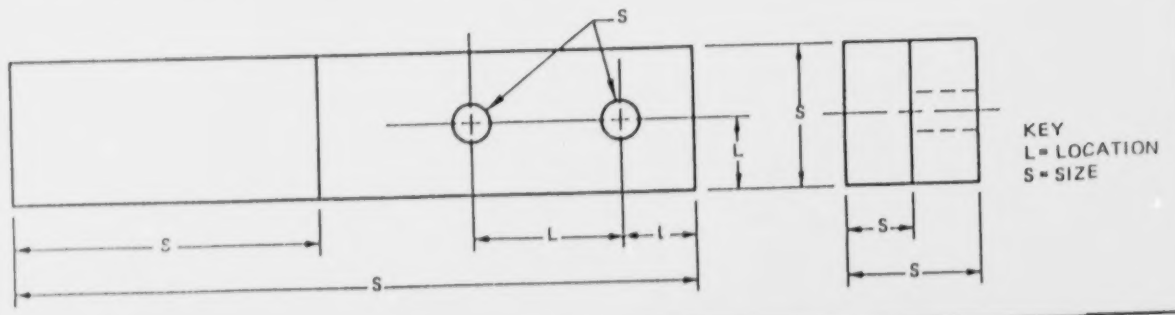
Dimensions

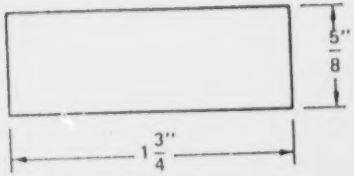
Dimensions serve two important functions on a print:

1. They give the sizes needed to fabricate a part.
2. They indicate the location where components of the part should be placed, assembled, machined or welded.

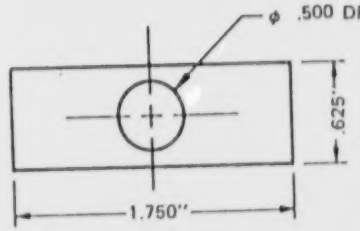
Size and location of dimensions:



Fractional Inch



Decimal Inch



NOTE: THE SYMBOL ϕ SIGNIFIES DIAMETER.

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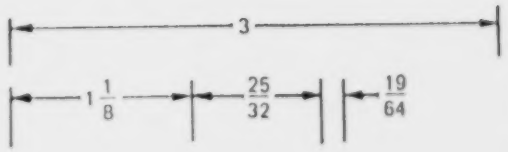
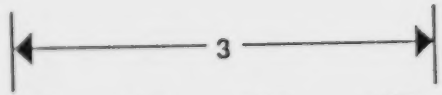
Dimensioning Units

Some dimensions are shown in fraction inches. In the Fractional Inch System, sizes are expressed in common fractions, the smallest division being 64ths.

Fractional Inch Example



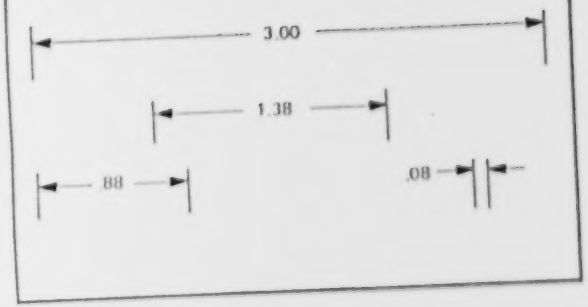
Onan - Fractional Inch



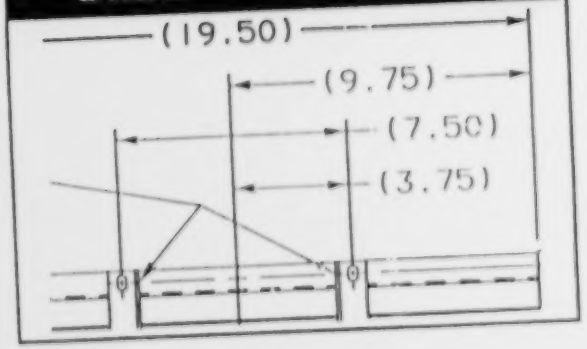
Dimensioning Units

In the decimal inch system (U.S. Customary), parts are designed in basic decimal increments, preferable .02 inch and are expressed as two-place decimal numbers. Using the .02 module, the second decimal place (hundreths) is an even number or zero. Sizes other than these, such as .25 are used when they are essential to meet design requirements.

Decimal Inch Example



Onan - Decimal Inch



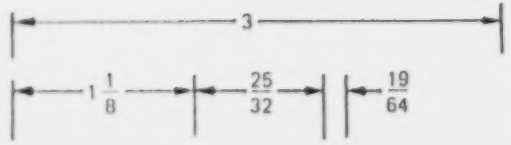
39

37

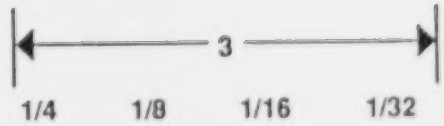
Dimensioning Units

Some dimensions are shown in fraction inches. In the Fractional Inch System, sizes are expressed in common fractions, the smallest division being 64ths.

Fractional Inch Example



Onan - Fractional Inch



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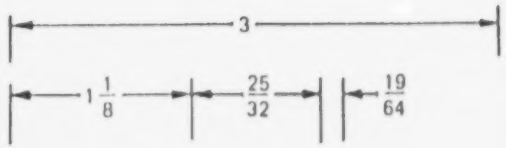
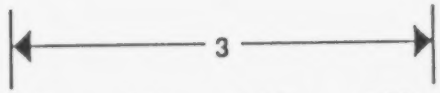
Dimensioning Units

Some dimensions are shown in fraction inches. In the Fractional Inch System, sizes are expressed in common fractions, the smallest division being 64ths.

Fractional Inch Example



Onan - Fractional Inch



41

42

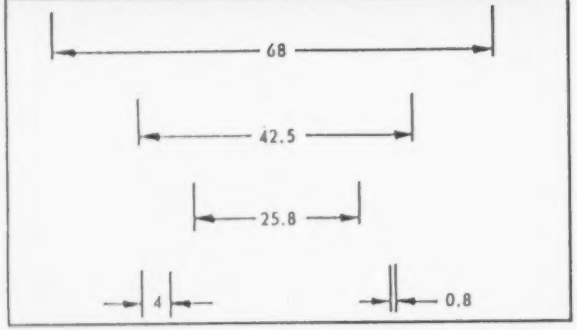
Dimensioning Units

Some projects are dimensioned in metric or millimeters. The SI Metric Unites of Measurement shows engineering drawings in: millimeters for the linear measure and micro meters for surface roughness. A millimeter value of less than one is shown with a zero to the left of the decimal point.

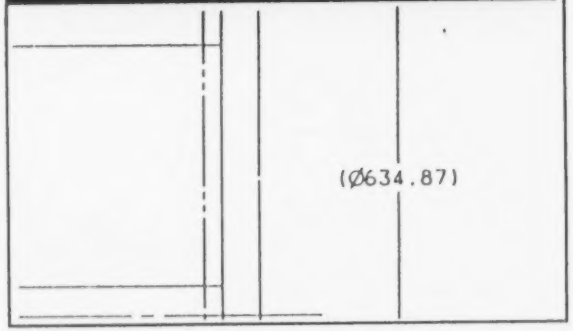
For example:

0.2	not	.2 or .20
0.26	not	.26

SI Metric Units Example



Onan - SI Metric Units



43

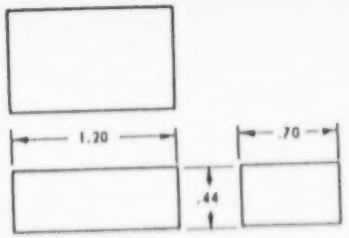
44

Basic Rules for Dimensioning

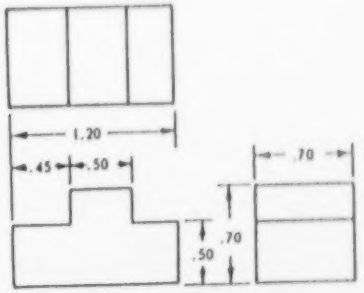
1. Place dimensions between views when possible (See A).

2. Place the dimension line for the shortest width, height, and depth, nearest the outline of the object (See B).
   Parallel dimension lines are placed in order of their size, making the longest dimension line the outermost line.

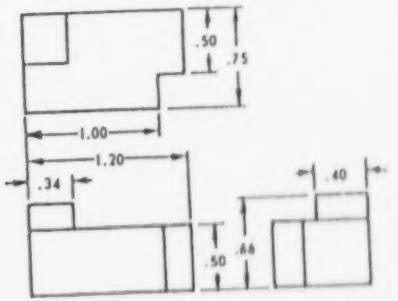
3. Place dimensions near the view that best shows the shape of the object (See C).



(A) PLACE DIMENSIONS BETWEEN VIEWS



(B) PLACE SMALLEST DIMENSION NEAREST THE VIEW BEING DIMENSIONED



(C) DIMENSION THE VIEW THAT BEST SHOWS THE SHAPE

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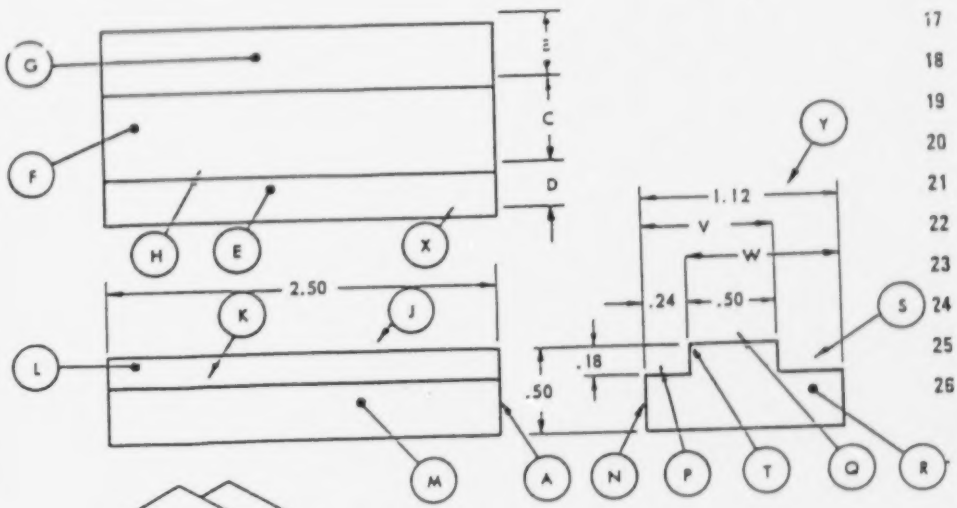
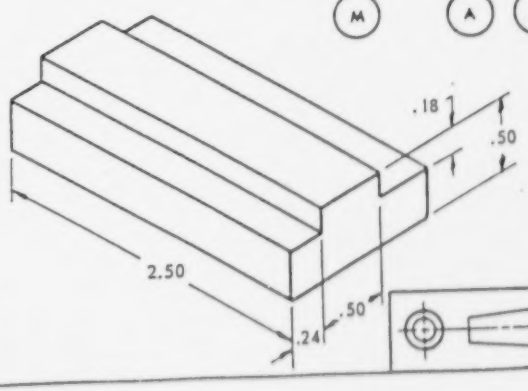
QUESTIONS

1. What is the name of the object?
2. What is the drawing number?
3. How many pieces are to be made?
4. Of what material is the part made?
5. What is the overall width?
6. What is the overall depth?
7. What is the overall height?
8. Which line or surface in the side view represents surface (F) in the top view?
9. Which line or surface in the side view represents surface (E) in the top view?
10. Which line or surface in the side view represents surface (G) in the top view?
11. Which line or surface in the side view represents surface (L) of the front view?
12. What is the vertical height in the side view from the surface represented by line (P) to that represented by line (Q)?
13. What is the height of the step in the side view from the bottom of the part to the surface represented by surface (E)?
14. Which two dimensions (letters) in the top view represent distance V in the side view?
15. Which two dimensions (letters) in the top view represent distance W in the side view?
16. Which line or surface in the side view represents surface (M) in the front view?
17. What is the height of line (N)?
18. Which line or surface in the front view represents the surface (R) in the side view?
19. Which line or surface in the top view represents surface (L)?
20. Which line or surface in the front view represents surface (F)?
21. Which line or surface in the front view represents surface (E)?
22. Which line or surface in the top view represents surface (M)?
23. What type of line is (T)?
24. What type of line is (Y)?
25. What units of measurement are used on this drawing?
26. Calculate dimensions B, C, D, and W.

ANSWERS

1 _____
2 _____
3 _____
4 _____
5 _____
6 _____
7 _____
8 _____
9 _____
10 _____
11 _____
12 _____
13 _____
14 _____
15 _____
16 _____
17 _____
18 _____
19 _____
20 _____
21 _____
22 _____
23 _____
24 _____
25 _____
26 B _____
C _____
D _____
W _____





QUANTITY	2
MATERIAL	MS
SCALE	FULL SIZE
DRAWN	DATE
COUNTER CLAMP BAR	A—6

Tolerance Dimensions

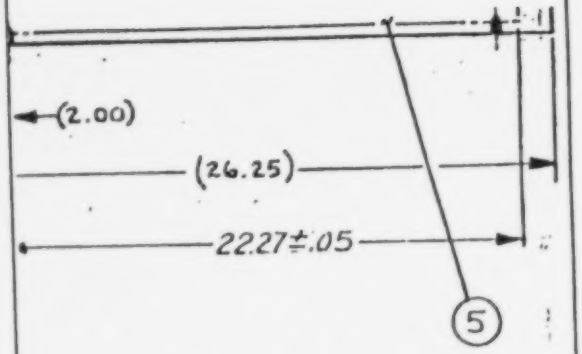
Tolerance is another important element of dimensioning. It is a figure given a plus (+) or minus (-) quality.

- It specifies the amount of error allowed when making a part.
- Tolerances are used to ensure the accuracy and proper fit of parts. This allows assembly and construction with the minimum of rework or adjustment.
- For many parts, tolerances are standardized and are found in prepared tolerance tables.

Tolerance Table

TOLERANCE UNLESS OTHERWISE SPECIFIED		
	**	Inch
DIM	X ± X.X ± X.XX ±	X ± .06 XX ± --- XXX ± ---
HOLE	0.09- 4.99 +0.15/-0.08 5.00- 9.99 +0.20/-0.10 10.00-17.49 +0.25/-0.13 17.50-24.99 +0.30/-0.13	.004- .200 +.006/-.003 .201- .421 +.008/-.004 .422- .783 +.010/-.005 .784- .999 +.012/-.005
ANG TOL ± 2°		DRAWN TO SCALE OF 1/4

Tolerance - Specific Weld



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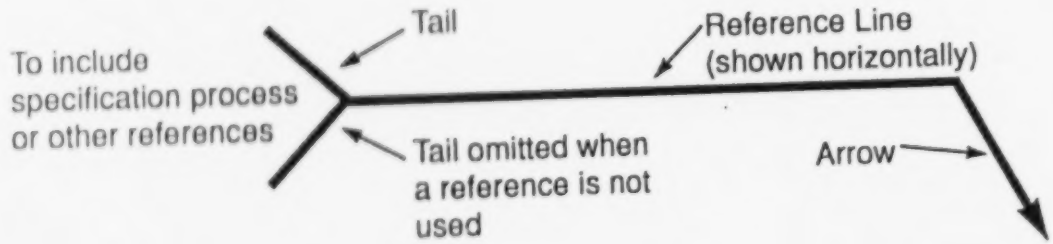
Welding Symbol

The standard welding symbol consists of a reference line, an arrow and a tail.

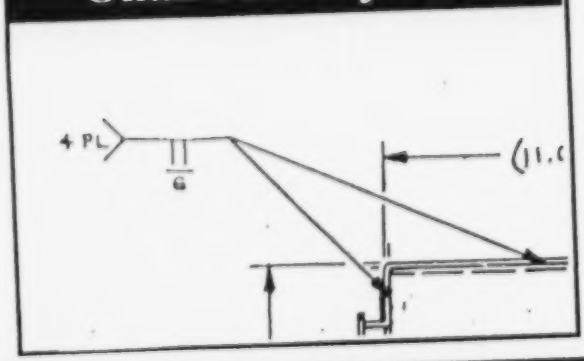
Reference Line: Used to apply weld symbols and other data

Arrow: Connects the reference line to the join or area to be welded

Tail: Used to indicate a specification process or other reference



Onan Print Symbol



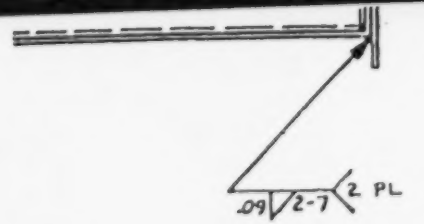
Identify:

1: Reference Line

2: Arrow

3: Tail

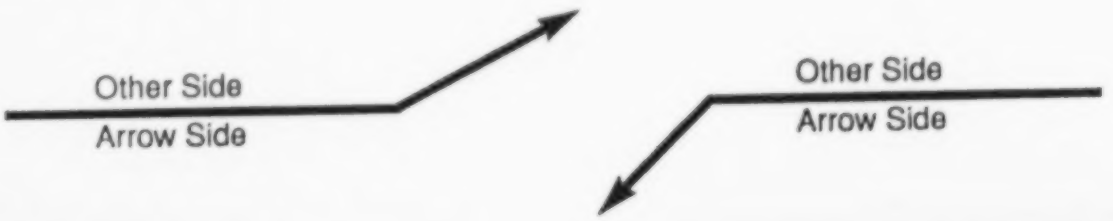
Onan Print Symbol



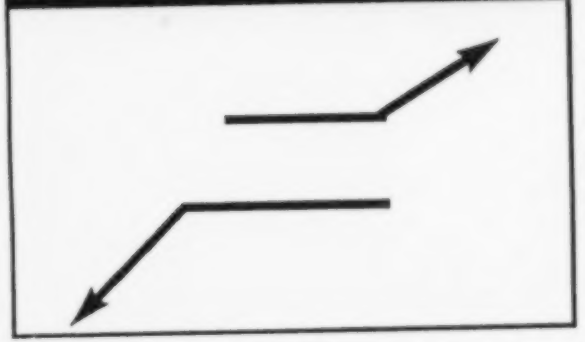
Reference Lines

The reference line of the weld symbol is always drawn horizontal to the bottom of the print.

- The lower side of the reference line is termed the arrow side and the upper side is termed the other side.
- The terms "arrow side" and "other side" apply to the location of the weld with respect to the joint.

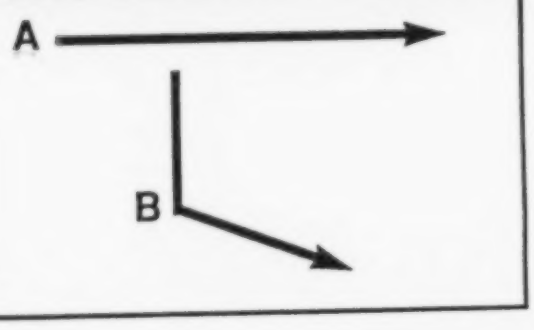


Correct Reference Lines



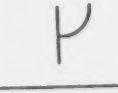
Why are the reference lines A and B Incorrect?

Incorrect Reference Lines

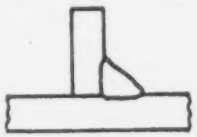


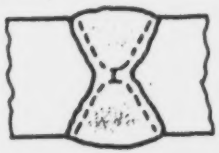
Basic Weld Symbols

FILLET	PLUG OR SLOT	SPOT OR PROJECTION	STUD	SEAM	BACK OR BACKING	SURFACING	FLANGE	
							EDGE	CORNER

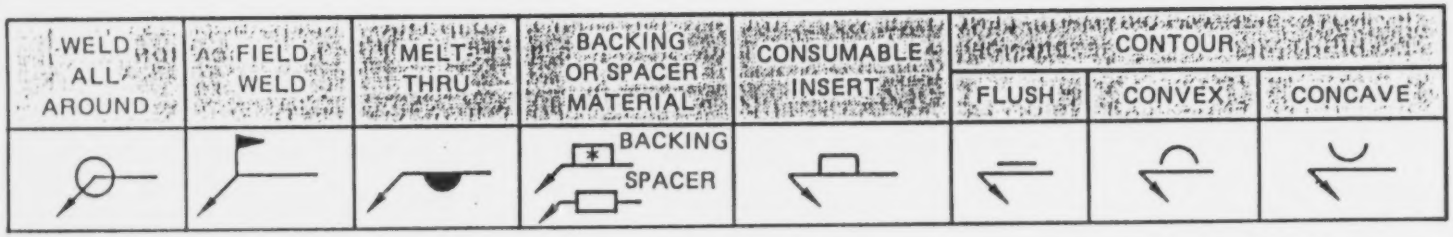
GROOVE							
SQUARE	SCARF	V	BEVEL	U	J	FLARE-V	FLARE-BEVEL
							

Types of Welds

WELD	SINGLE	DOUBLE
FILLET		
SQUARE		
BEVEL GROOVE		

WELD	SINGLE	DOUBLE
V GROOVE		
J GROOVE		
U GROOVE		

Supplementary Symbols



Weld All Around: Welds extended continuously around the joint are indicated by placed the weld all-around symbol at the break of the reference arrow.

Melt through: The melt-through symbols is used only when complete root penetration plus visible reinforcement is required in weld made from one side.

Backing or Spacer Material: Used to indicate bead-type back or backing welds of single groove welds. The back weld is made after the groove weld. The backing is made before the groove weld.

Contour: Supplementary contour symbols are used with the weld symbols to indicate how the face of the weld is to be finished: flush, concave or convex.

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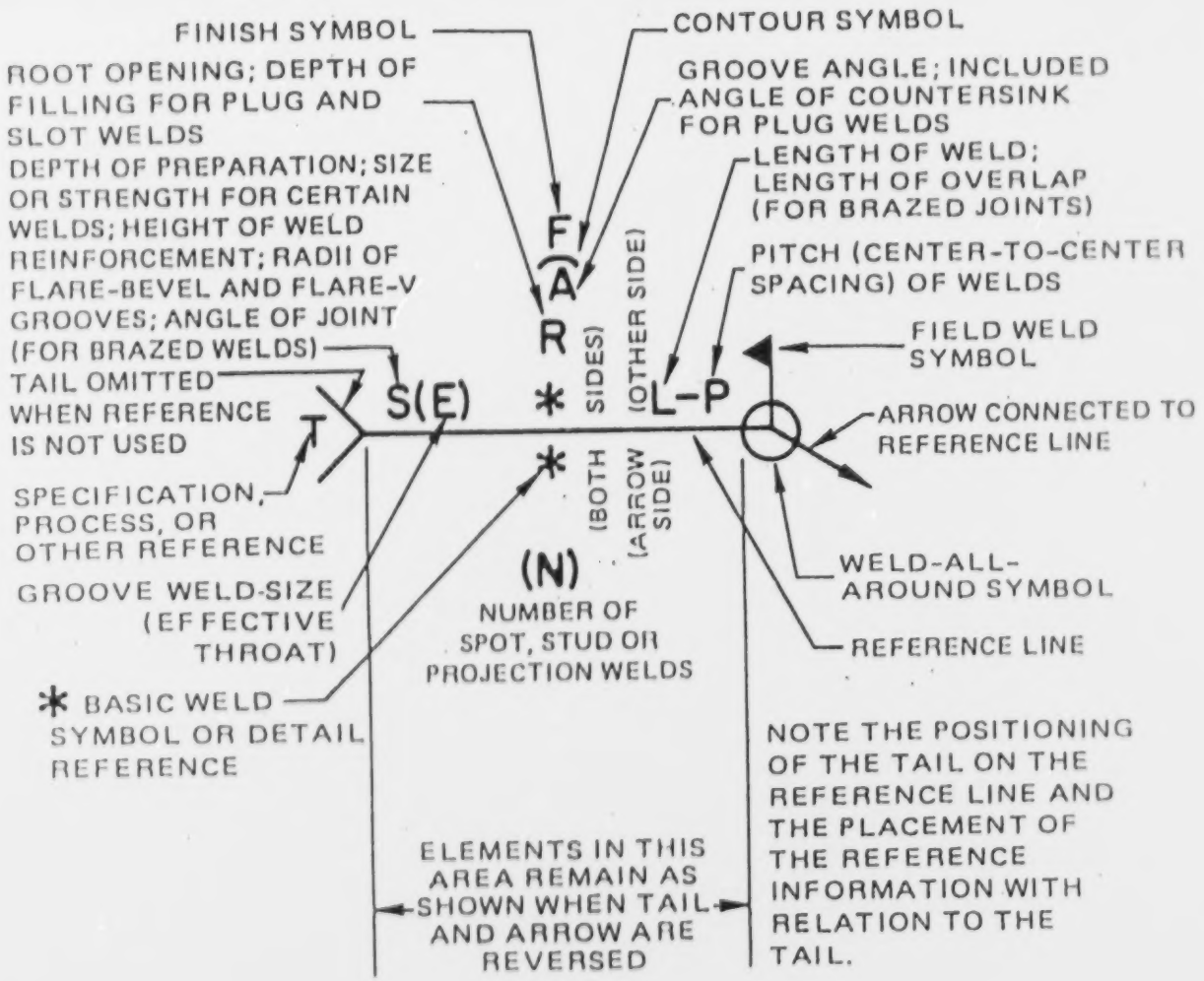
Welding Symbol & Elements

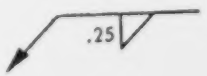

FINISH SYMBOL
CONTOUR SYMBOL
ROOT OPENING; DEPTH OF FILLING FOR PLUG AND SLOT WELDS
GROOVE ANGLE; INCLUDED ANGLE OF COUNTERSINK FOR PLUG WELDS
LENGTH OF WELD; LENGTH OF OVERLAP (FOR BRAZED JOINTS)
DEPTH OF PREPARATION; SIZE OR STRENGTH FOR CERTAIN WELDS; HEIGHT OF WELD REINFORCEMENT; RADII OF FLARE-BEVEL AND FLARE-V GROOVES; ANGLE OF JOINT (FOR BRAZED WELDS)
PITCH (CENTER-TO-CENTER SPACING) OF WELDS
FIELD WELD SYMBOL
TAIL OMITTED WHEN REFERENCE IS NOT USED
S(E)
F
A
R
*
(OTHER SIDE)
SIDES)
L-P
ARROW CONNECTED TO REFERENCE LINE
SPECIFICATION, PROCESS, OR OTHER REFERENCE
(BOTH
(ARROW SIDE)
WELD-ALL-AROUND SYMBOL
GROOVE WELD-SIZE (EFFECTIVE THROAT)
(N)
NUMBER OF SPOT, STUD OR PROJECTION WELDS
REFERENCE LINE
* BASIC WELD SYMBOL OR DETAIL REFERENCE
NOTE THE POSITIONING OF THE TAIL ON THE REFERENCE LINE AND THE PLACEMENT OF THE REFERENCE INFORMATION WITH RELATION TO THE TAIL.
ELEMENTS IN THIS AREA REMAIN AS SHOWN WHEN TAIL AND ARROW ARE REVERSED

Your Notes

Fillet Welds

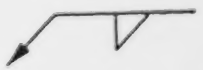
1. Fillet weld symbols are drawn with the perpendicular leg always to the left.

2. Dimensions of fillet welds are shown on the same side of the reference line and to the left of the weld symbol.



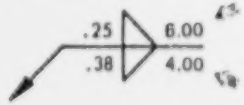
3. The dimensions of fillet welds on both sides of a joint are shown whether the dimensions are identical or different.

4. The dimension does not need to be shown when a general note is placed on the drawing to specify dimension of fillet welds.

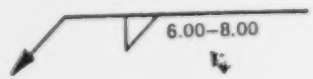


NOTE: SIZE OF FILLET WELDS .25 UNLESS OTHERWISE SPECIFIED.

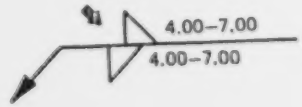
5. The length of a fillet weld, when indicated on the welding symbol, is shown to the right of the weld symbol.



6. The pitch (center to center spacing) of an intermittent fillet weld is shown as the distance between centers of increments on one side of the joint. It is shown to the right of the length dimension following a hyphen.

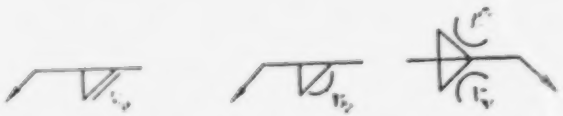


7. Staggered intermittent fillet welds are illustrated by staggering the weld symbols.



Fillet Welds

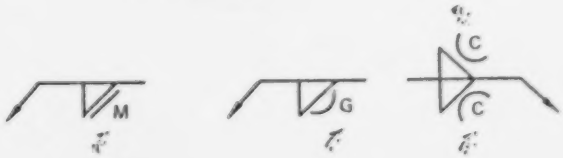
8. Fillet welds that are to be welding with approximately flat, convex, or concave faces without postweld finishing are specified by adding the flab, convex, or concave contour symbols to the weld symbol.



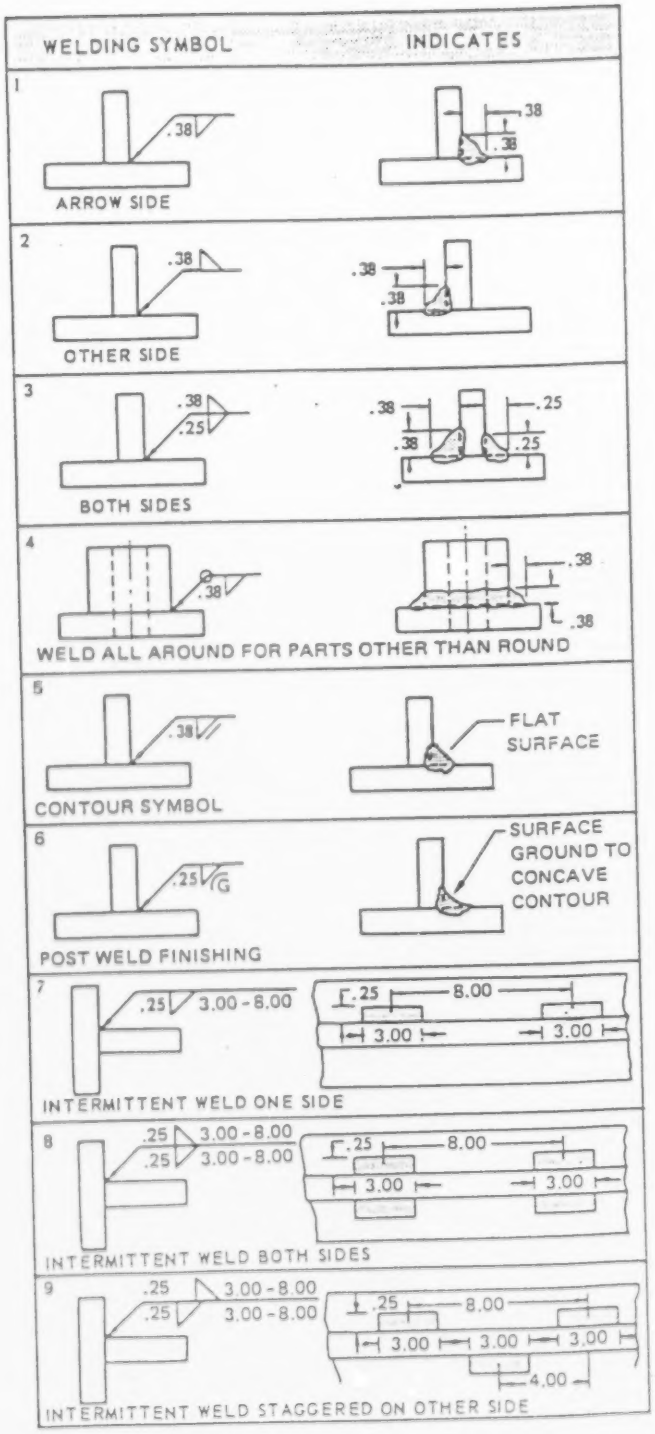
9. Fillet welds whose faces are to be finished approximately flax, convex, or concave by postweld finishing are specified by adding both the appropriate contour and finishing symbol to the weld symbol.

The following finishing symbols may be used to specify the method of finishing, but not the degree of finish:

C - Chipping
G - Grinding
H - Hammering
M - Machining
R - Rolling



Fillet Welds



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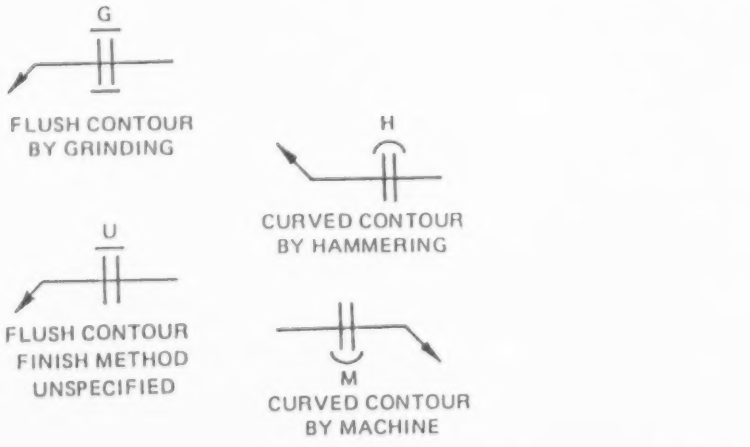
Finishes

Finish symbols may be used with contour symbols to indicate the method to be used for forming the contour of the weld.

Letter designations are used for this purpose:

C is for Chipping
G is for Grinding
M is for Machining
R is for Rolling
H is for Hammering
U is for Unspecified

A standard finish mark may be applied to the contour symbol with a numerical degree of finish shown above the finish mark.



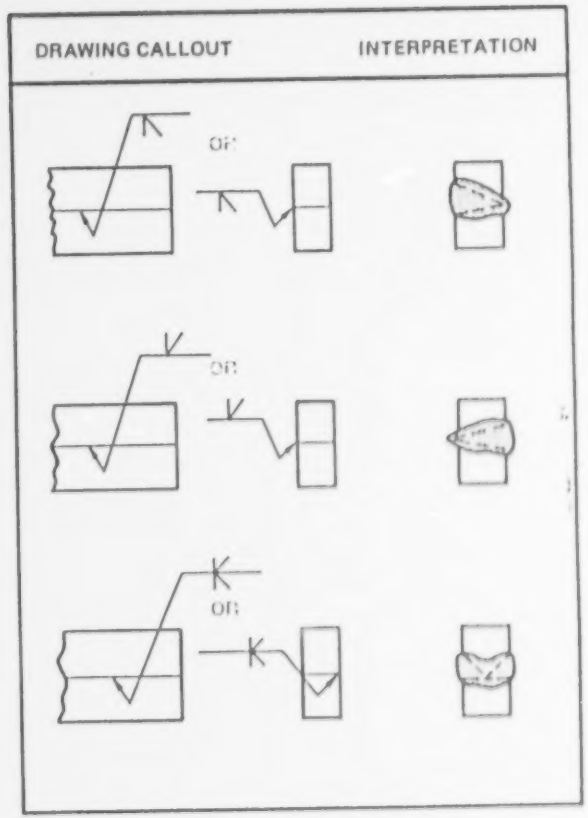
Groove Welds

1. Bevel-groove, J-groove, and flare bevel-groove weld symbols are always drawn with the perpendicular leg to the left.

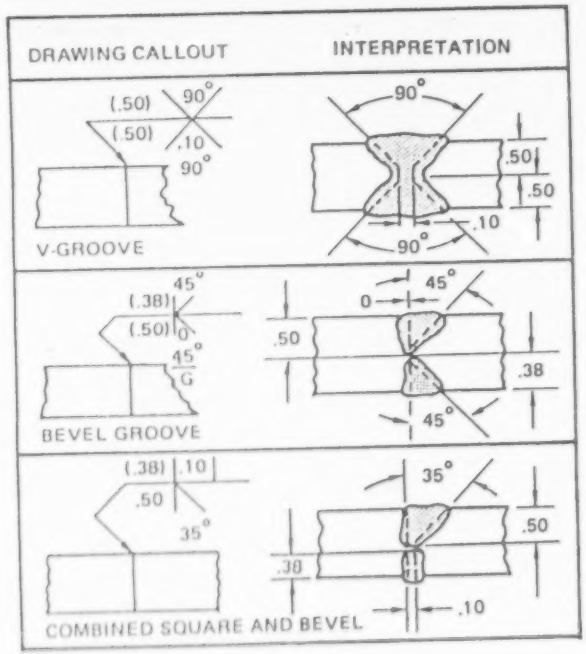
2. Dimensions of single groove welds are shown on the same side of the reference line as the weld symbol.

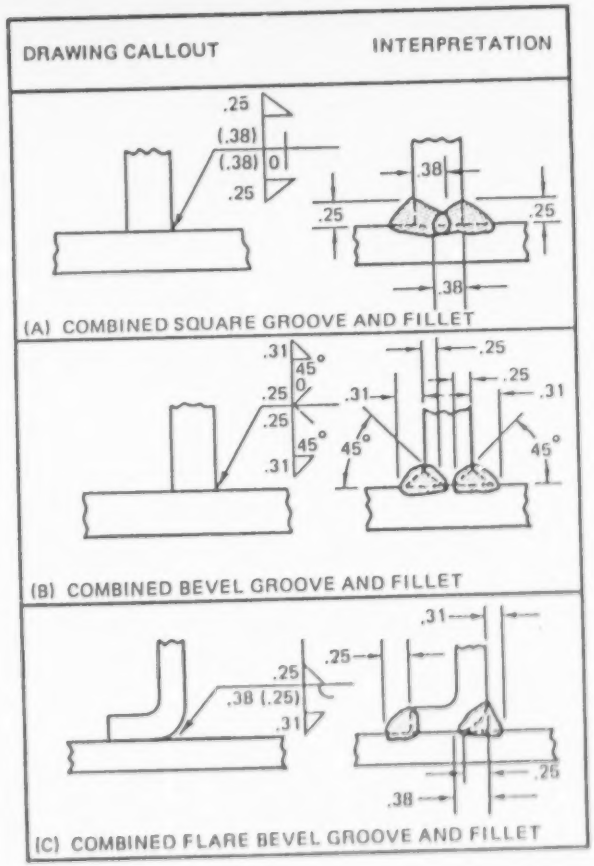
3. Each groove of a double-groove joint is dimensioned, however the root opening need appear only once.

4. For bevel-groove and J-groove welds, a broken arrow is used, when necessary, to identify the member to be prepared.



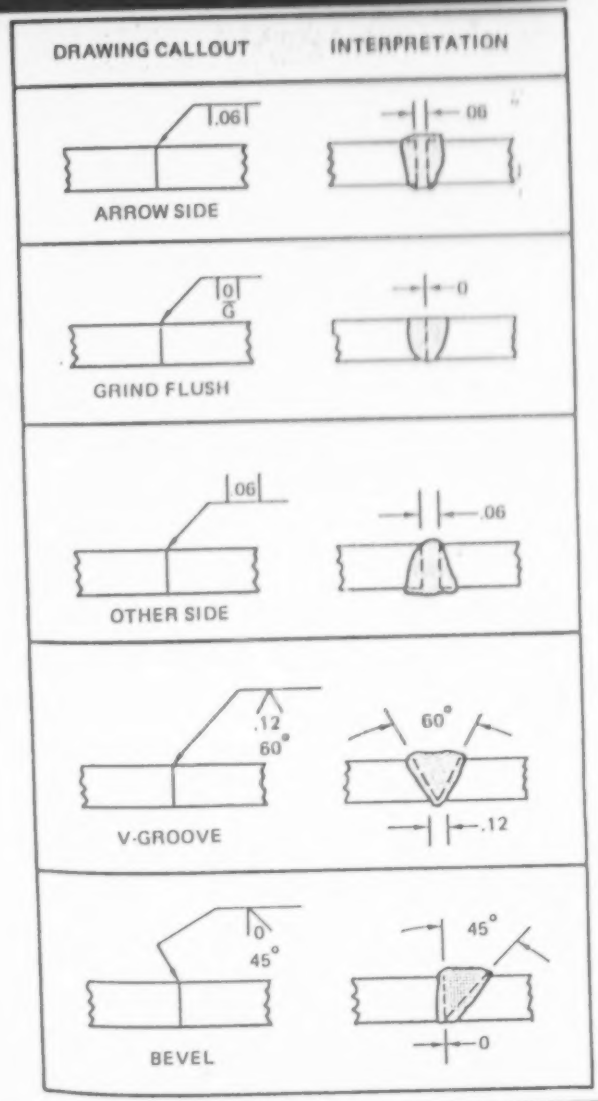
Groove Welds





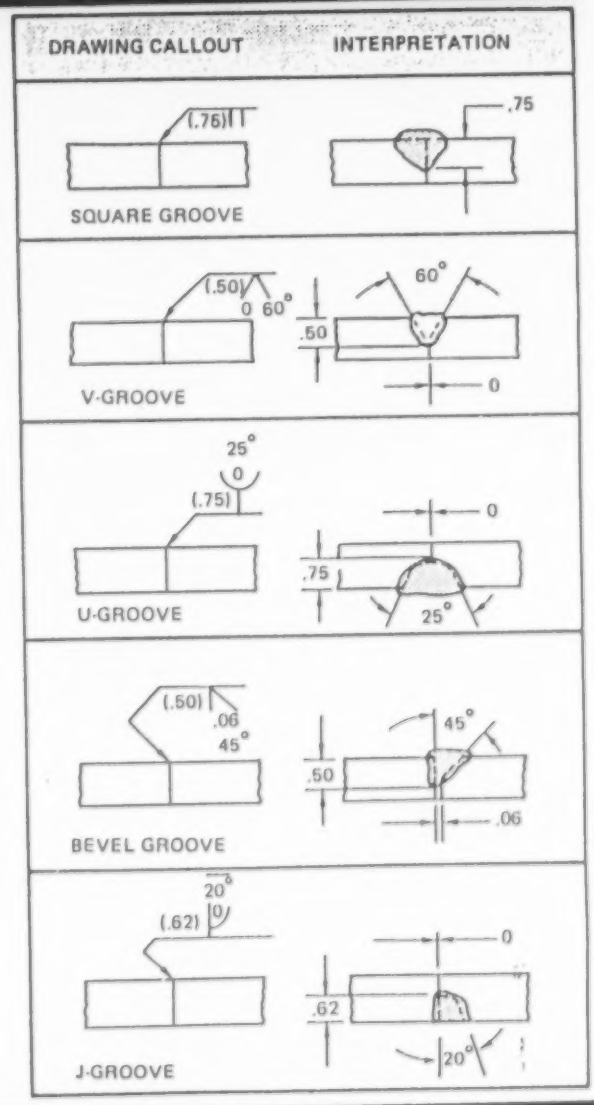
Groove Welds

5. When no depth of groove preparation and no groove weld size are specified on the welding symbol for single-groove and symmetrical doublegroove welds, complete joint preparation is required.



Groove Welds

6. When the groove welds extend only partly through the member being joined, the size of the weld is shown on the weld symbol



Groove Welds

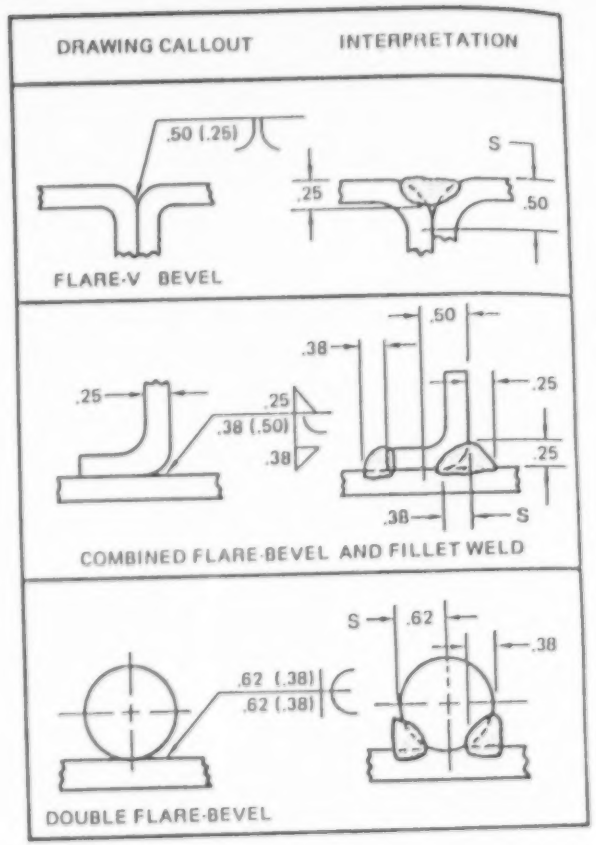
7. A dimension not in parenthesis placed to the left of bevel, V-, J-, or U-groove weld symbols indicate only the depth of preparation.

8. Groove welds that are to be welded with approximately flush or convex faces without post-weld finishing are specified by adding the flush or convex contour symbol to the welding symbol.

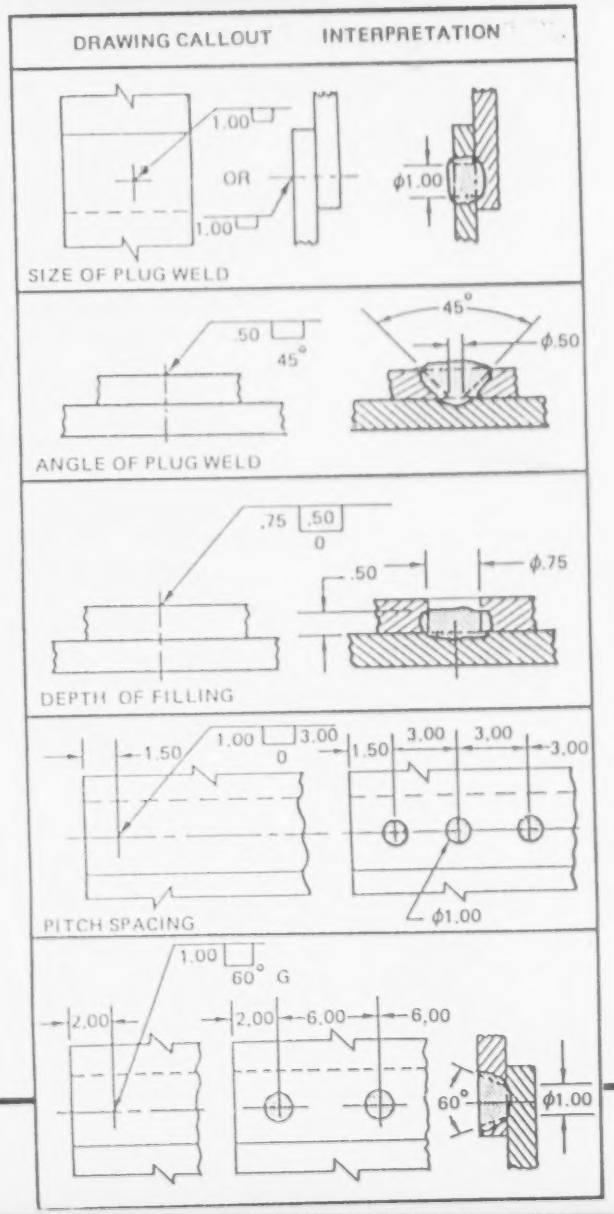
9. Groove welds whose faces are to be finished blush or convex by postweld finishing are specified by adding both the appropriate contour and finishing symbol to the weld symbol. Standard finishing symbols are:

   C - Chipping
   G - Grinding
   H - Hammering
   M - Machining
   R - Rolling

10. The size of flare-groove welds when no weld size is given is considered as extending only to the tangent point indicated by dimensions "S".



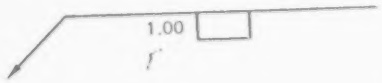
Plug Welds



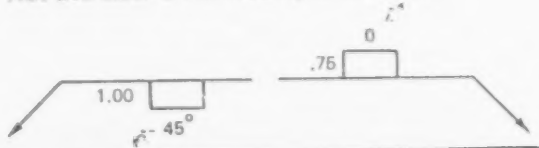
1. Holes in the arrow-wide member of a joint for plug welding are specified by placing the weld symbol below the reference line.

2. Holes in the other-side member of a joint for plug welding are indicated by placing the weld symbol above the reference line.

3. The size of a plug weld is shown on the same side and to the left of the weld symbol

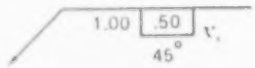


4. The included angle of countersink of plug welds is the user's standard, unless otherwise indicated. Included angle, when not the user's standard, is shown.

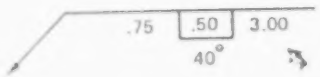


Plug Welds

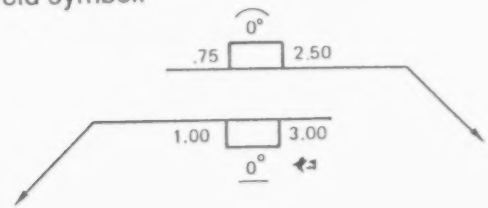
5. The depth of filling of plug welds is complete unless otherwise indicated. When the depth of filling is less than complete, the depth of filling, in inches or millimeters, is shown inside the weld symbol.



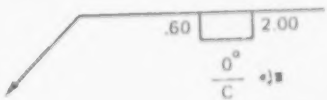
6. Pitch (center-to-center spacing) of plug welds is shown to the right of the weld symbol.

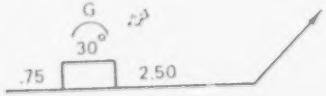


7. Plug welds that are to be welded with approximately flush or convex faces without postweld finishing are specified by adding the flush or convex contour symbol to the weld symbol.



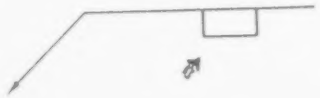
8. Plug welds whose faces are to be finished approximately flush or convex by postweld finishing are specified by adding both the appropriate contour an finishing symbol to the welding symbol. Welds that require a flat but not flush surface require and explanatory note in the tail of the symbol.



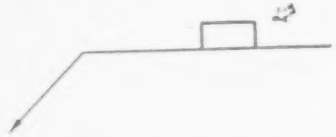


Slot Welds

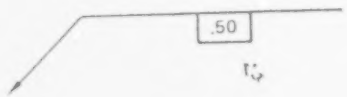
1. Slots in the arrow-wide member of a joint for slot welding are indicated by placing the weld symbol below the reference line. Slot orientation must be shown on the drawing.

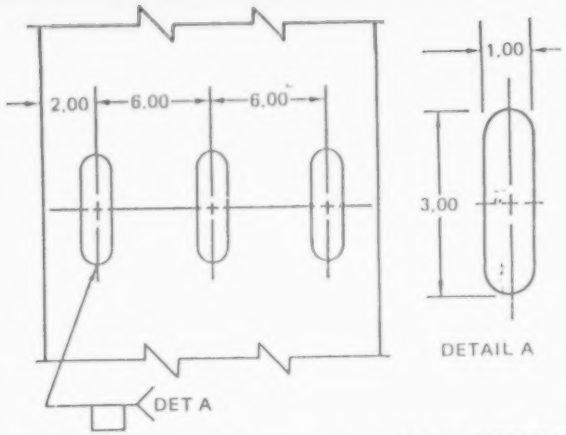


2. Slots in the other-side member of a joint for slot welding are indicated by placing the weld symbol above the reference line.

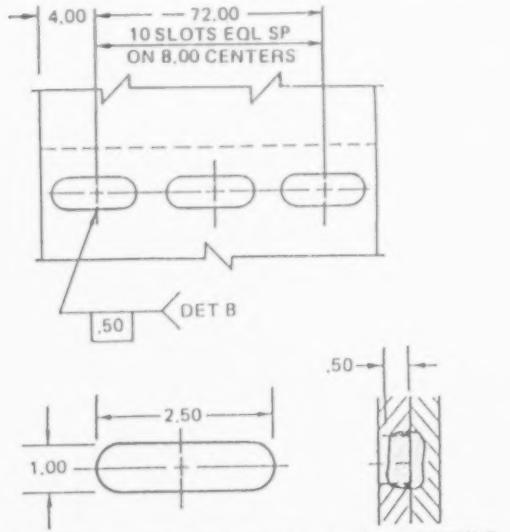


3. Depth of filling slot welds is complete unless otherwise indicated. When the depth of filling is less than complete, the depth of filling, in inches or millimeters, is shown inside the welding symbol.





EXAMPLE 1 SLOTS PERPENDICULAR TO LINE OF WELD



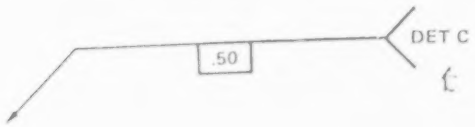
DETAIL B SLOTS PARALLEL TO LINE OF WELD

85

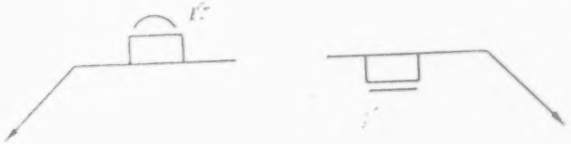
86

Slot Welds

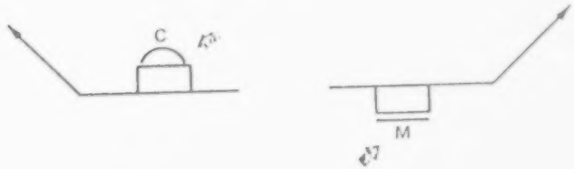
4. Length, width, spacing, included angle of countersink, orientation, and location of slot welds cannot be specified on the welding symbol. These data are to be specified on the drawing or by a detail with reference to it on the welding symbol.



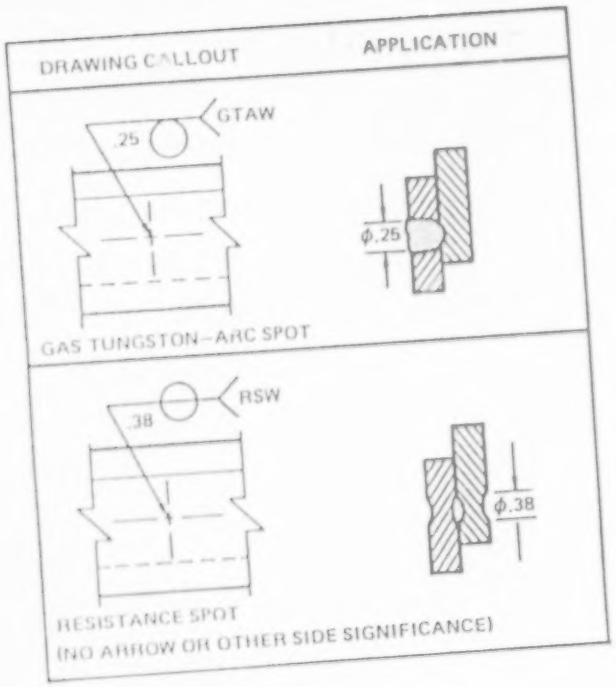
5. Slot welds that are to be welded with approximately finish or convex faces without postweld finishing are specified by adding the finish or convex contour symbol to the weld symbol.



6. Slot welds whose faces are to be finished approximately flush or convex by postweld finishing are specified by adding both the appropriate contour and finishing symbol to the welding symbol. Welds that require a flab but not flush surface require an explanation note in the tail of the symbol.



Spot Welds

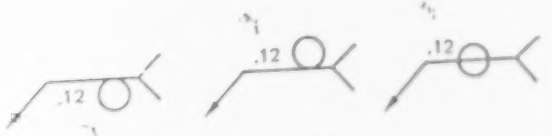


1. The symbol for all spot or projection welds is a circle, regardless of the welding process used. There is not attempt to provide symbols for different ways of making a spot weld, such as resistance, arc, and electron beam welding. The symbol for a spot weld is a circle placed:

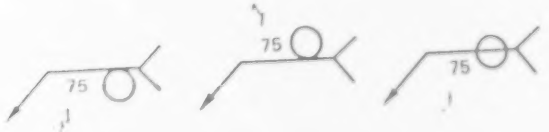
- Below the reference line, indicated arrow side
- Above the reference line, indicated other side
- On the reference line, indicating that there is no arrow or other side

Spot Welds

2. Dimensions of spot welds are shown on the same side of the reference line as the weld symbol. or on either side when the symbol is located astride the reference line and has not arrow-side or other side significance. They are dimensioned by either the size or the strength. The side is designated as the diameter of the weld at the faying surfaces and is shown to the left of the weld symbol The strength of the spot weld is designated in pounds or newtons per spot and is shown to the left of the weld symbol.



SPECIFYING DIAMETER OF SPOT



SPECIFYING STRENGTH OF SPOT

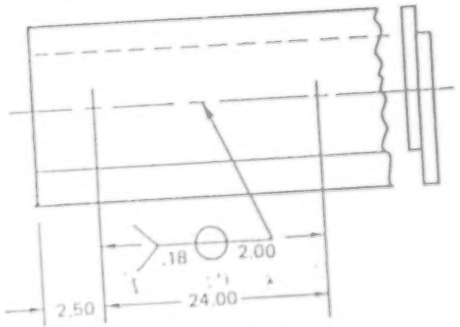
3. The process reference is to be indicated in the tail of the welding symbol.

4. When projection welding is used, the spot weld symbol is used and the projection welding process is referenced in the tail of the symbol. The spot weld symbol is located above or below (not on) the reference line to designate on which member the embossment is placed.

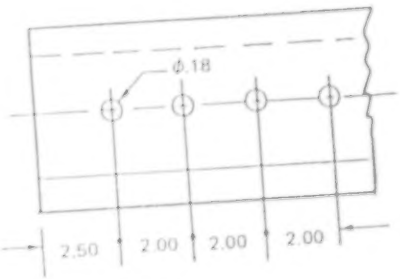
5. The pitch (center-to-center spacing) is shown to the right of the weld symbol.

Spot Welds

6. When spot welding extends less than the distance between abrupt changes in the direction of the welding or less than the full length of the joint, the extent is dimensioned.



(A) DRAWING CALLOUT

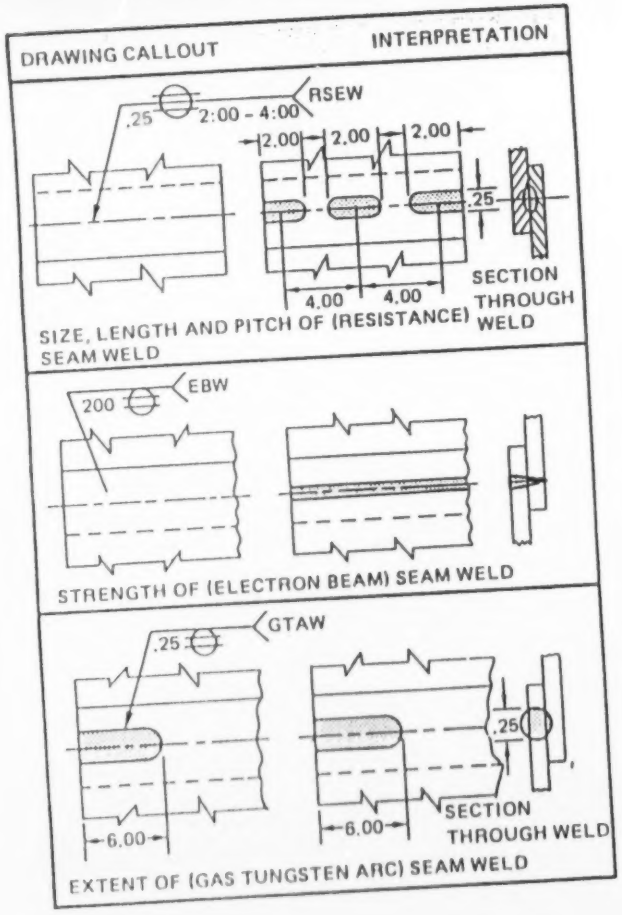


INTERPRETATION

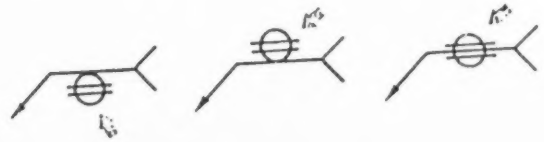
7. Where the exposed surface of either member of a spot welded joint is to be welded with approximately flush or convex faces without postweld finish, that surface is specified by adding the flush or convex contour symbol to the weld symbol.

8. Spot welds whose faces are to be finished approximately flush, or convex by postweld finishing are specified by adding both the appropriate contour and fishing symbol to the welding symbol. Welds that requires a flat but not flush surface require and explanatory note in the tail of the symbol.

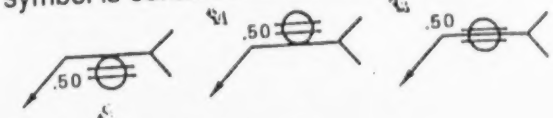
Seam Welds



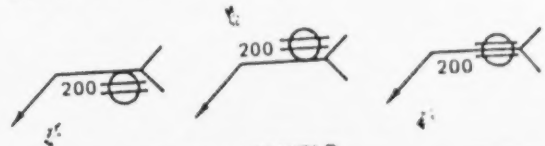
1. The symbol for all seam welds is a circle traversed by two horizontal parallel lines. This symbol is used of all seam welds regardless of the way they are made. The seam welds symbol is placed (1) below the reference line to indicate arrow wide, (2) above the reference line to indicate other side, and (3) on the reference line to indicate that there is not arrow or other side significance.



2. Dimensions of seam welds are shown on the same side of the reference line as the weld symbol or all other either side when the symbol is centered on the reference line.



SPECIFYING WIDTH OF WELD



SPECIFYING STRENGTH OF WELD

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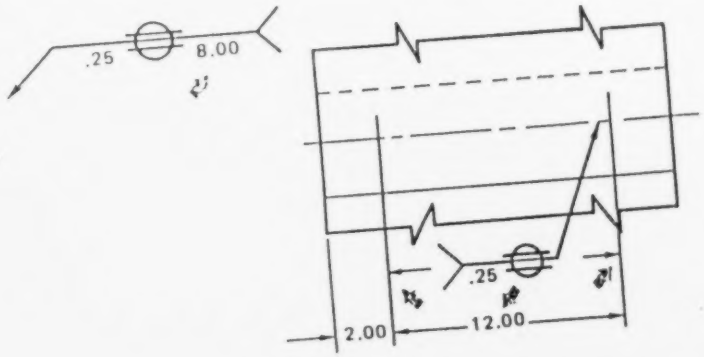
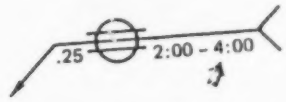
Seam Welds

3. The process reference is indicated in the tail of the welding symbol.

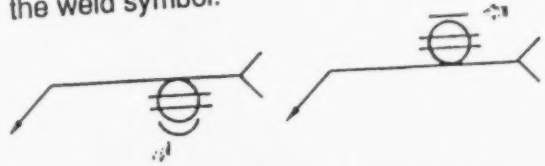
4. The length of a seam weld, when indicated on the welding symbol, is shown to the right of the weld symbol. when seam welding extends for the full distance between abrupt changes in the direction of the welding, not length dimensions needs to be shown on the welding symbol. When a seam weld extends less than the full length of the join, the extend of the weld should be shown.



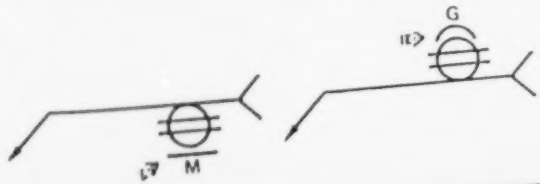
5. The pitch of an intermittent seam weld is shown as the distance between centers of the weld increments. The pitch is shown to the right of the length dimension.



6. When the exposed surface of either member of a seamwelded joint is to be welded with approximately flush or convex faces without postweld finishing that surface is specified by adding the flush or convex contour symbol to the weld symbol.



7. Seam welds with faces to be finished approximatelh flush or convex are specified by adding both the approximate contour and finish symbol to the welding symbol.



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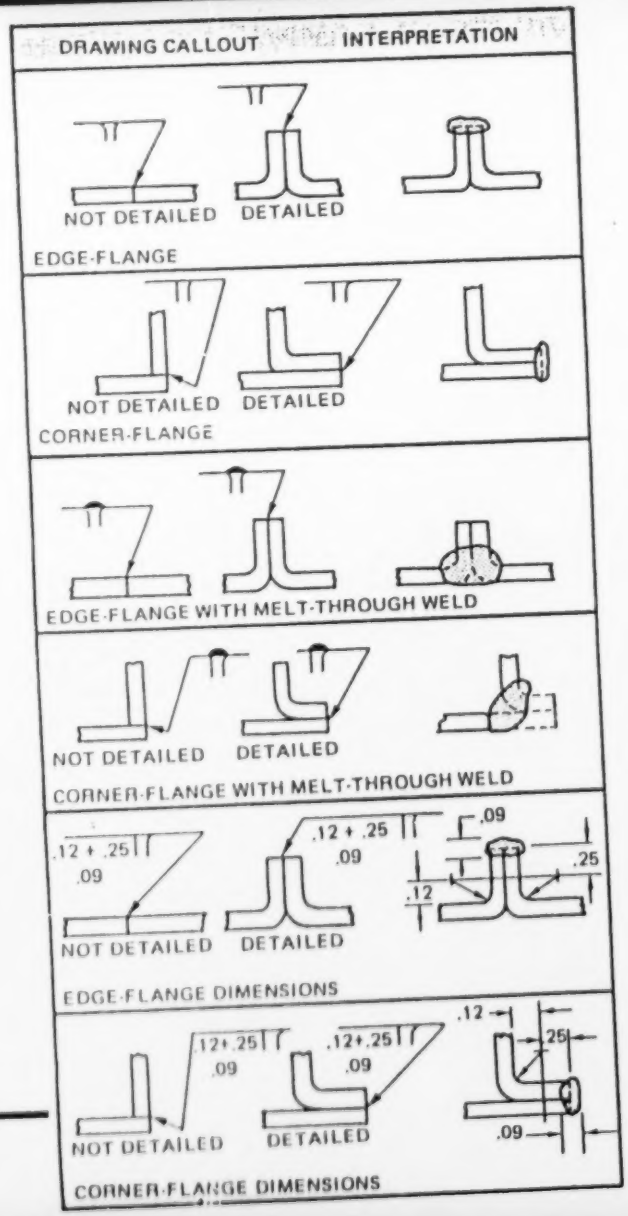
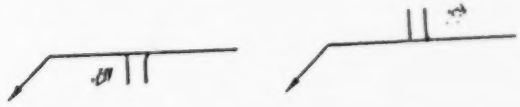
Flange Welds



The following welding symbols are intended to be used for light-gage metal joints involving the flaring or flanging of the edges to be joined.

1. Edge-flange welds are shown by the edge-flange-weld symbol.



2. Corner-flange welds on joints detailed on the drawing are specified by the corner-flange weld symbol., Weld symbols are always drawn with the perpendicular leg to the left.

3. Corner-flange welds on joints not detailed on the drawing are specified by the corner-flange weld symbol. A broken arrow points to the member being flanged.

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Flange Welds

4. Edge-flange welds requiring complete joint penetration are specified by the edge-flange weld symbol with the melt-though symbol placed on the opposite side of the reference line. The same welding symbol is used for joints either detailed or not detailed on the drawing.

5. Corner-flange welds requiring complete joint penetration are specified by the corner-flange weld symbol with the melt-through symbol placed on the opposite side of the reference line. A broken arrow points to the member to be flanged where the joint is not detailed.

JOINT DETAILED JOINT NOT DETAILED

6. Dimensions of flange welds are shown on the same side of the reference line as the weld symbol The radius and the height, separated by a plus (+) are placed to the left of the weld symbol. The radius and the height read in that order from left to right along the reference line.

WHERE T = WELD THICKNESS
H = HEIGHT OF FLANGE
R = RADIUS OF FLANGE

7. The size (Thickness) of flange welds is specified by a dimension placed above or below the flange dimensions.